Action principle for continuous quantum measurement (Supplementary Material)

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QUANTUM JUMP ANIMATIONS

Quantum jump movie 1

(See *movie1.mov* in the Supplemental Material or at `http://youtu.be/OQ3PwkSKEUw`).

This movie shows different constant stochastic energy paths on the phase portrait as in Fig. 2 (in the main text). The colored lines are related to different stochastic energies: $E = 0$ (dashed blue), $E = E_c = -\Delta^2\tau/2$ (solid black), $E < E_c$ (dotted red), $E > 0$ (dotted grey). The colored dots move as the integrated time $T = \int_{\theta_i}^{\theta_f} \dot{\theta}(\theta, E)^{-1} \mathrm{d}\theta$ increased. Starting at $\theta_i = 0$ and choosing the corresponded values of $p_\theta(\theta_i, E)$, the blue ($E = 0$), black ($E = E_c$), orange ($E < E_c$) and grey ($E > 0$) dots move toward increased angle θ. While starting at $\theta_i = \pi/2$ with chosen values of $p_\theta(\theta_i, E)$, the pink ($E < E_c$) and brown ($E > 0$) dots move in the opposite direction and follow their constant energy (red and grey) lines. Note that the blue and grey dots represent two successful switching paths from $\theta_i = 0$ to $\theta_f = \pi$. The black dot with the critical energy can never pass through the crossing point (see inset of Fig. 2 (in the main text)). The pink and orange dots represent the paths with stochastic energy below the critical value, therefore the paths turn back to the pole of origin. We also show the brown dot starting from $\theta_i = \pi/2$ and approaching the pole $\theta = 0$ at infinite time. Each path is associated with different probability densities, computed from the action Eq. (11) (in the main text).

Quantum jump movie 2

(See *movie2.mov* in the Supplemental Material or at `http://youtu.be/sTlV2amQtjQ`).

This movie shows the unitless measurement record $r(\theta)$ and $r(t)$ for different stochastic energies. The color of the dots and lines are as defined in the caption of Movie1.mov above. We show the paths of measurement record r as a function of θ and t. As the integrated time is increased, the colored dots move according to their values of θ and r. The range of the plots are chosen to capture important dynamics around the crossing point.